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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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Masuo Kondo

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12/06/2006

NIXON PEABODY, LLP

401 9TH STREET, NW

SUITE 900

WASHINGTON, DC 20004-2128

EXAMINER

ROMAN, ANGEL

ART UNIT

PAPER NUMBER

2812

DATE MAILED: 12/06/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/529,172	Applicant(s) KONDO ET AL.	
	Examiner Angel Jr Roman	Art Unit 2812	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 24 March 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-35 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 16-25 is/are allowed.
- 6) ☒ Claim(s) 1-9, 11-14, 27, 28, 31, 32 and 34 is/are rejected.
- 7) ☒ Claim(s) 10, 15, 26, 29, 30, 33 and 35 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 24 March 2005 is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>03/24/05, 11/22/05, 06/06/06</u> | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Information Disclosure Statement

1. The information disclosure statements (IDS) submitted on 03/24/2005, 11/22/2005 and 06/06/2006 are being considered by the examiner.

Specification

2. The lengthy specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.
3. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

Claim Objections

4. Claims 15, 26 and 35 are objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Claims 15 and 26 are drawn to a solder ball and therefore does not further limit the method steps of claims

8 and 16-25; claim 35 is drawn to a semiconductor device and does not further limit claims 1, 15, 26 and 28 drawn to a solder ball.

Claim Rejections - 35 USC § 112

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claims 1-7 and 28-35 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

7. Claims 1 and 28 recites the limitation "the amount of water" in lines 5 and 8 respectively. There is insufficient antecedent basis for this limitation in the claim.

8. Claims 2-7 and 29-35 are rejected for their dependency on claims 1 and 28 respectively.

Claim Rejections - 35 USC § 102

9. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

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(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

10. Claims 1, 2, 4-7 are rejected under 35 U.S.C. 102(e) as being anticipated by Martin et al. U.S. Patent 7,053,491 B2 filed 02/04/2002.

Regarding claim 1, Martin et al. discloses a solder ball comprising a spherical core (32), and a solder layer (34), which includes Sn and Ag (see column 2, lines 40-44) and which is provided so as to wrap the core up (see figure 2), the solder layer (34) is made of pure eutectic therefore an amount of water contained in the solder layer is 100 ul/g or less, e.g. 0 ul/g, when represented by the amount of water vapor in standard conditions (see column 2, lines 40-44).

Regarding claim 2, Martin et al. discloses the solder layer (34) including an Sn-Ag alloy (see column 2, lines 40-44).

Regarding claim 4, Martin et al. discloses the core being made of Cu, Al or a resin (see column 2, lines 38-40).

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Regarding claim 5, Martin et al. discloses the solder layer including 0.5 mass % to 4.0 mass % of Ag (see column 2, lines 40-44).

Regarding claim 6, Martin et al. discloses the solder layer including Cu, Sn and Ag (see column 3, lines 55-67 and column 4, lines 1-14).

Regarding claim 7, Martin et al. discloses the solder layer including 3.5 mass % of Ag (see column 2, line 42).

11. Claims 1, 3, 8, 27 are rejected under 35 U.S.C. 102(e) as being anticipated by Palmteer U.S. Patent 6,781,065 B1 filed 06/08/2000.

Regarding claim 1, Palmteer discloses a solder ball comprising a spherical core (102), and a solder layer (104, 106), which includes Sn and Ag (see column 3, lines 60-65 and column 4, lines 1-29) and which is provided so as to wrap the core (102) up (see figure 3), the solder layer (104, 106); wherein an amount of water contained in the solder layer is 100 ul/g or less, e.g. 0 ul/g, when represented by the amount of water vapor in standard conditions.

Regarding claim 3, Palmteer et al. discloses the solder layer including a first metal layer (104), which is provided so as to wrap the core (102) up, and a second metal layer (106), which is provided so as to wrap the first metal layer up, and wherein

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one of the first and second metal layers includes Sn and the other metal layer includes Ag (see column 3, lines 60-65 and column 4, lines 1-29).

Regarding claim 8, Palmteer discloses a method of making a solder ball (100), the method comprising the steps of: preparing a spherical core (102); forming a plating layer (104, 106), including Sn and Ag, by an electroplating technique (see column 4, lines 1-16) such that the plating layer wraps the core up (see figure 3); heating the core with the plating layer, thereby keeping the plating layer molten for a predetermined period of time; and solidifying the molten plating layer, thereby making a solder layer (see column 5, lines 45-67 and column 6, lines 1-15).

Regarding claim 27, Palmteer discloses preparing a board (220) on which pads (222) of a conductive material are arranged; putting and heating the solder balls (212) on the pads, thereby turning the solder layer into a molten solder layer; and solidifying the molten solder layer (see figure 5).

12. Claims 8 and 11 are rejected under 35 U.S.C. 102(e) as being anticipated by Ichida et al. U.S. Patent 6,518,667 B1 filed 10/27/2000.

Regarding claim 8, Ichida et al. discloses a method of making a solder ball, the method comprising the steps of: preparing a spherical core (29); forming a plating layer (31, 33), including Sn and Ag, by an electroplating technique (see column 13, lines 1-

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13) such that the plating layer wraps the core up (see figure 2); heating the core with the plating layer, thereby keeping the plating layer molten for a predetermined period of time; and solidifying the molten plating layer, thereby making a solder layer (see figure 10).

Regarding claim 11, Palmteer discloses a forming the plating layer including the steps of: forming a first plating layer, including Sn, such that the first plating layer wraps the core up, and forming a second plating layer, including Ag, such that the second plating layer also wraps the core up (see column 13, lines 1-13).

Claim Rejections - 35 USC § 103

13. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

14. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.

4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

15. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

16. Claims 8, 9, 12-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Martin et al. U.S. Patent 7,053,491 B2 filed 02/04/2002 in view of Palmteer U.S. Patent 6,781,065 B1 filed 06/08/2000.

Regarding claim 8, Martin et al. discloses a method of making a solder ball, the method comprising the steps of: preparing a spherical core (32); forming a layer (34), including Sn and Ag (see column 2, lines 40-44) such that the plating layer wraps the core up (see figure 2); heating the core with the plating layer, thereby keeping the plating layer molten for a predetermined period of time; and solidifying the molten plating layer, thereby making a solder layer (see Figure 6). Martin et al. is applied as above but lacks anticipation on disclosing an electroplating process for forming the

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metal layers; Palmteer discloses forming a solder layer on a core by using an electroplating process (see column 4, lines 14-16), therefore it would have been obvious to a person having ordinary skills in the art at the time the invention was made to use an electroplating process as disclosed in Palmteer in the primary reference of Martin et al. in order to obtain a desire film uniformity and since it is a technique known in the art for depositing metal layers as clearly disclosed in Palmteer (see column 4, lines 14-16).

Regarding claim 9, Martin et al. discloses forming the layer including the step of forming an alloy layer including Sn and Ag (see column 2, lines 40-44).

Regarding claim 12, Martin et al. discloses the solder layer including Cu, Sn and Ag (see column 3, lines 55-67 and column 4, lines 1-14).

Regarding claim 13, Martin et al. discloses the solder layer including 0.5 mass % to 4.0 mass % of Ag (see column 2, lines 40-44).

Regarding claim 14, Martin et al. discloses the solder layer including 3.5 mass % of Ag (see column 2, line 42).

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17. Claims 28, 31, 32 and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Martin et al. U.S. Patent 7,053,491 B2 filed 02/04/2002 in view of Abbott et al. U.S. Patent 6,337,445 B1 dated 01/08/2002

Regarding claim 28 Martin et al. is applied as above but lacks anticipation on disclosing the first solder layer including 0.5 mass % to 2.5 mass % of Ag. Abbott et al. discloses a solder layer having an Ag mass between 0.5-2.5 % (see column 9, lines 40-47), in view of this disclosure, it would have been obvious to a person having ordinary skills in the art at the time the invention was made to use the lead-free solder disclosed in Abbott et al. in the primary reference of Martin et al. since it would increase product reliability.

Regarding claim 31 Martin et al. discloses the first solder layer having a thickness of 3 um to 50 um (see column 3, lines 59-60).

Regarding claim 32 Martin et al. discloses the core being made of Cu, Al or a resin (see column 2, lines 38-44).

Regarding claim 34 Martin et al. discloses the core having a diameter of 0.05 mm to 1 mm (see column 2, lines 38-44).

Allowable Subject Matter

18. Claims 16-25 are allowed.
19. Claims 10 and 29 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.
20. Claims 30 and 33 are objected to as being dependent upon a rejected base claim and would be allowable for their dependency on objected claim 29.
21. The following is a statement of reasons for the indication of allowable subject matter: The prior art of record failed to anticipate or render obvious the limitations of electroplating the Ag and Sn layers using a phosphine solution as required by claim 16 or forming an additional Ag layer as required by claims 10 and 29.

Conclusion

22. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Jiang et al., Call et al., Gilleo et al., Suppelsa and Takahashi et al. disclose solder balls having cores.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Angel Jr Roman whose telephone number is (571) 272-6369. The examiner can normally be reached on IFP Mo-Fr 6am-3pm.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Lebentritt can be reached on (571) 272-1873. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

AR



MICHAEL LEBENTRITT
SUPERVISORY PATENT EXAMINER